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Dynamic perspective of capability development in organizational learning

-From absorptive capacity to combinative capability-

역동적 관점에서 본 조직학습에서의 학습역량 발전에 관한 연구

– 흡수역량에서 결합역량으로 –

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International commerce

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-From Absorptive Capacity to Combinative Capability-

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Abstract

Dynamic perspective of capability development in organizational learning

-From absorptive capacity to combinative capability-

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Since learning and knowledge have been regarded as key factors for business innovation, many scholars focus heavily on firm's ability to learn and utilize knowledge: absorptive capacity (Cohen and Levinthal, 1990; Zahra and George, 2002) and combinative capability (Kogut and Zander, 1992; Grant, 1996). However, despite of growing use of the constructs, the proliferation of these two capabilities brought two challenges to be handled: conceptual overlap between two concepts,

and lack of explanation about dynamic process of capability development.

Based on literature review about learning capabilities, this paper finds that the overlap between absorptive capacity and combinative capability can play a potential role on bridging two concepts, and offer a combined framework. First, in terms of overlapping part, this paper finds that the similarity and differences between two concepts can explain the gap between exploration to exploitation.

Second, the combined framework depicts the development of learning capability according to handling knowledge. However, this paper sees that the capability development should be consistent with the knowledge management process after acquisition of external knowledge so, the framework describes that the importance of capability changes from absorptive capacity to combinative capability as a firm excels in handling knowledge. That is, this research argues that knowledge management process of knowledge recipient can be explained through the combined framework of absorptive capacity and combinative capability. In this framework, the research arranges the capabilities which require the process from exploration to exploitation according to the extent which knowledge is disassembled, and offers detailed description about each capability.

Moreover, the research attempts to connect between firm's growth stages and the development of organizational capacity through longitudinal case study of POSCO. Based on the five-stage model (Miller and Friesen; 1984), the history of POSCO was divided into four stages of the five-stage model, and analyzed from capability development perspective. The case study gives two implications: theoretically, the case study shows the offered framework can effectively analyze the development of

the firm's organizational learning. Empirically, the case study represents the process that knowledge learner becomes knowledge creator in industry, as the firm is matured.

The contribution of this research lies in helping to understand three points; first, by distinguishing the differences and similarities of absorptive capacity and combinative capability, it gives clear understanding about these two seemingly different concepts. Second, by offering combined framework, it helps to understand the knowledge management process, starting from knowledge exploration to exploitation from knowledge recipient perspective. Third, by offering the case study, the research gives insights about the relationship between firm's growth stages and the development of organizational capacity, and elicits propositions about the dominance of specific learning capability at each stage

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Key word: Organizational learning, Absorptive capacity, Combinative capability, Dynamic perspective, Case Theoretic Approaches, Korean steel producer

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1. Introduction

As organizational learning prospers in the field of strategic management, it gives various research agenda to business scholars, such as organizational learning (Levitt and March, 1988; Miner, Basoff and Moorman, 2001), learning capability (Cohen and Levinthal, 1990; Zahra and George, 2002; Lichtenthaler and Lichtenthaler, 2009), knowledge transfer (Gupta and Govindarajan, 2000; Tsai, 2001), and knowledge integration (Kogut and Zander, 1992; Grant, 1996a). Despite the proliferation of research related to knowledge transfer and learning capability, not many studies have observed how transferred knowledge can contribute to the recipient's capability building and its evolution. To what extent and how can the transferred knowledge contribute to the evolution of capability? And what mechanism works for it? To deal with these questions, this research gives a more comprehensive explanation of knowledge management process from the knowledge receiver's perspective at the organizational capability level, especially focusing on the transition from exploration to exploitation in organizational learning.

Among organizational capabilities related to learning, absorptive capacity (ACAP) and combinative capability (CCAP) are most widely accepted and researched. However, despite the growing use of the constructs, the proliferation of these two capabilities has brought two limitations to light. First, these constructs are often limited to specific knowledge processes (Lichetenthaler and Licheterthaler, 2009). This limited dimension of the concept has challenged many scholars to explain full

dimension of knowledge management, so the individual concept has been extended to explain untouched dimensions of organizational learning. However, the extensions of individual concepts brought the overlap among the concepts, and this overlap confuses the original focal point of the concepts. Secondly, not many researchers have focused on the dynamic process of organizational learning. Although some scholars have explained the dynamic process of organizational learning with knowledge creation (Nonaka, 1994), the interactional process between individual and organization in cognitive structure (Crossan, Lane and White, 1999), not much research focuses on the development of learning capability from dynamic perspective at organizational level.

In dealing with the limitations of the existing studies mentioned above, the research questions are addressed. In terms of the first limitation about the overlapping part, this research distinguishes the differences and similarities of two capabilities. Second, in terms of the second limitation, the lack of researches regarding the dynamic process of capability development, this research observes how learning capability evolves as firm manages its knowledge.

In regard to the two research questions, this paper argues that a black box which connects the exploration and exploitation can be understood with similarity between realized absorptive capacity and recombinant creation of combinative capability. Moreover, the knowledge management process after knowledge acquisition can be explained through the combined framework of absorptive capacity and combinative capability. That is, although the extended concepts of absorptive capacity and combinative capability blur the boundary of each concept, they also contain some

potential to bridge between the two concepts. Based on the overlapping part between two concepts, this research offers the combined framework of absorptive capacity and combinative capability to explain dynamic evolution of firm's learning capability. Such a framework may contribute to a more general construct of the dynamic process of knowledge management from exploration to exploitation. To explain the dynamic process of capability development, this paper takes a dynamic capability view (Teece, Pisano, and Shuen, 1997; Helfat, et al., 2009) of the firm and examines the development of capability along with processing the acquired knowledge in organizational level. Lastly, by connecting between the firm's growth stages and the development of organizational capacity, the research looks into what kinds of capabilities in the framework are dominantly utilize and elicits some propositions at each stage of firm's growth by analyzing the longitudinal case study of Korean steel maker, POSCO.

This paper is structured as follows. First, section 2 scrutinizes some related concepts: the knowledge transfer from recipient perspective, and learning capabilities, absorptive capacity and combinative capability. Based on the literature review, it draws some limitations of the existing studies and the research questions. Second, based on the careful analysis of the overlapping part of the two concepts, section 3 offers the distinction between absorptive capacity and combinative capability, and a combined framework of the two concepts. Here, the research explains the development of learning capability and each dimension of the framework. Furthermore, section 4 connects the framework with the firm's growth stage model, and elicits some propositions about the dominant utilizations of the capabilities at

each stage of firm's growth through case study. In section 4 I briefly explain an adapted methodology for the empirical study and discussions related to case study. In section 5, the research discusses the contributions of the research and suggestions for the future studies.

2. Theoretical background

Although there are lacks of previous studies which deal with the evolution of the organizational capability according to processing transferred knowledge, many researchers have offered firm grounds for this topic with the studies of knowledge transfer, and learning capabilities. So, this paper scrutinizes the previous researches with three categories. On the one hand, it will look into the previous research about knowledge transfer from recipient's perspective. Although this study deals with the cognitive and operational actions at the organizational capability level after receiving the knowledge, it will be worthwhile to trace how previous scholars have looked into the knowledge recipient and its role as a determinant of knowledge transfer. This suggests that, the process of capability building and evolution is in the extended line with the knowledge transfer. That is, in this paper, I argue that, in real practice, learning capability evolution process is the simultaneous or sequential step with knowledge transfer. Thus, as a first part of literature review, it is important to

look into the existing studies of knowledge transfer as previous or antecedent step of capability building.

On the other hand, this paper closely scrutinizes previous researches about organizational learning and learning capability. In terms of organizational learning which is related to the firm's innovation, most scholars argue that both exploration and exploitation are vital for innovation of firms (March, 1991). Under the these two concepts, many scholars have investigated how these two types of learning can contribute to the firm's success, and coined the capabilities required for these two different exercises. Considering that innovations of a firm are the result of either applying new knowledge (knowledge exploration) or reconfiguring existing knowledge (knowledge exploitation) (Grant, 1996a), absorptive capacity (Cohen and Levinthal, 1990; Kim, 1998; Zhara and George, 2002) and combinative capability (Kogut and Zander, 1992; Grant, 1996a; Carnabuci and Operti, 2013) are the most relevant organizational capability to these two concepts. Therefore, Rest two parts will delve into these capabilities related to knowledge exploration and exploitation. In terms of two capabilities, although past researchers share some implicit characteristics of absorptive capacity and combinative capability, their operational scope where these capabilities reach varies in accordance with the definitions of the scholars. Therefore, as second and third parts of literature review, this paper will explore the different definitions and operational scopes of the two capabilities and how the two concepts have been developed.

2.1Knowledge receiver as a determinant of knowledge transfer

The importance of knowledge receiver's characteristics as a determinant of knowledge transfer is implicitly shared consensus among scholars (Minbaeva, 2007). Broadly, in regards to the knowledge receiver's impact on knowledge transfer, absorptive capacity (Szulanski, 1996; Lane and Lubatkin, 1998; Gupta and Govindarajan, 2000; Minbaeva, 2007), and network of the knowledge receiver (Tsai, 2001; Hansen, Mors and Lovas, 2006) have been given a lot of scholarly attention. One of mainstream researches for a determinant of knowledge receiver is the network theory. Tasi (2001) argued the network position of the knowledge receiver is determinant on the types of knowledge which the receiver can access; therefore, the network position is an important determinant for the knowledge transfer. This argument was elaborated with the research about types of networks that knowledge receiver owns (Hansen, Mors and Lovas, 2006). Hansen et al (2006) distinguished the network the knowledge receiver owns into three types: within team network, inter-subsidiary network, and transfer network, and then analyzed how each different network affects on the knowledge transfer.

Moreover many scholars argued that absorptive capacity of knowledge receiver is an important determinant of knowledge transfer, in that the higher level of absorptive capacity is, the higher degree of knowledge can receive. Interestingly, Minbaeva et al (2004) distinguished the role of potential absorptive capacity and

realized absorptive capacity (Zahra and George, 2002) and found that the interaction between realized absorptive capacity and potential absorptive capacity increases the level of knowledge transfer to subsidiary.

Either network theory or learning theory, these studies proved that the knowledge receivers take an important role in knowledge transfer process. However, the studies narrowly focused on how these determinants affect on the types and the amount of the inbound knowledge to the recipient firm. Although it is widely accepted that transferred knowledge contributes to the evolution and development of the recipient firms, not much scholarly attention was given to observe how this transferred knowledge are utilized in a way of enhancing the competitiveness of the recipient. Therefore, this research attempts to observe how the knowledge receiver enhances its learning capability along with managing the acquired knowledge. Before, the research also examines another aspect of the research flow about learning capability: absorptive capacity (ACAP thereafter) and combinative capability (CCAP thereafter). Based on further investigation, the paper will draw limitation of the research and reveal the contribution of the research

2.2 Absorptive capacity

Organizational learning consists of mainly two different exercises: exploration and exploitation. Although these two exercises are required for firm's innovation and competitiveness building, these two concepts are not easily compatible at some

point in the organization each other (March, 1991). Under the two different exercises of learning, many scholars examined what capabilities are required to achieve these two different learning in organization. In this regard, ACAP is more related to the knowledge exploration in terms of searching and assimilating new knowledge. The concept of ACAP has been developed with the researchers' interest in ability to learn. Past researches indicated an implicit consensus about the roles of ACAP as a set of firm's abilities to manage knowledge, but its definitions and components varied according to the scholars (Zahra and George, 2002). In this paper, I broadly examine three past studies on ACAP offered by Cohen and Levinthal (1990), Kim (1997 a, b, 1998), and Zahra and George (2002). These past studies are generally accepted in the academic field so it needs to be scrutinized for the theoretical background.

Cohen and Levinthal (1990) offered the most widely accepted concept of ACAP. They referred to ACAP as "a firm's ability to recognize and assimilate the value of new information, and to apply it to commercial ends". The ACAP defined by Cohen and Levinthal (1990) is the most appropriate to refer the firm's capability related to knowledge exploration. According to this definition, ACAP contains the three aspects of its ability: the ability to acquire and assimilate the external information, and to exploit the acquired knowledge. So here, the focus is likely on identifying and transferring external knowledge into an organization rather than utilizing knowledge.

As scholars became more interested in the concept of ACAP, they added other dimensions of leaning such as transforming knowledge. Kim (1997a,b; 1998)

imparted the problem solving skills as one component of ACAP. According to his concept, ACAP requires both learning capacity and problem-solving skills; learning capability is the capacity to assimilate knowledge for imitation and problem-solving skills is the capacity to create new knowledge for innovation (Kim, 1998). In this case, "create new knowledge for innovation" means that based on the knowledge acquired through learning capacity, the firm should facilitate to transform the knowledge into another type of knowledge for different purpose.

Later, Zahra and George (2002) redefined ACAP as "a dynamic capability pertaining to knowledge creation and utilization that enhances a firm's ability to gain and sustain a competitive advantage". Interestingly, they regarded ACAP as the capability which can be transformed in accordance with knowledge management process, from knowledge acquisition to knowledge utilization. Here, the concept of ACAP was extended in a way of including both knowledge exploration and exploitation. According to their definition, ACAP consists of four dimensions of the firm's capabilities: Acquisition, Assimilation, Transformation and Exploitation. With the four dimensions, they categorized ACAP as two subsets: potential ACAP and realized ACAP. Specifically, potential ACAP comprises knowledge acquisition and assimilation capabilities, and realized ACAP centers on knowledge transformation and exploitation. Therefore in summary that realized ACAP is related to the knowledge exploitation; potential ACAP is related to the knowledge exploration. By scrutinizing the existing studies, we can infer that the concept of ACAP has been extended from the learning ability (Cohen and Levinthal, 1990) to the knowledge exploitation ability including transformation process (Kim, 1998;

Zhara and George, 2002).

2.3Combinative capability

The concept of CCAP (Kogut and Zander, 1992) has been developed based on the concept of core competence (Prahalard and Harmel, 1990). Analogous to the concept of core competence, CCAP originally refers to the firm's ability to utilize its current knowledge by combining and reconfiguring together. However, the concept itself is on the same line with the concept of knowledge integration within the firm. In terms of knowledge integration, two premises about knowledge are required. Firstly, knowledge of the firm is not merely the aggregate of the knowledge that workers owns but rather it is more likely to contain more than sum of the knowledge from their workers (Kogut and Zander, 1992). This assumption enables an organization to create organizational level knowledge regardless of changes in employees. Secondly, the knowledge is architectural knowledge whose specific components are integrated together in a coherent way (Henderson and Clark, 1990). The second assumption offers the rationale which disassembles the knowledge into specific pieces and combines these pieces in different ways. Based on these critical assumptions, Kogut and Zander (1992) introduced the concept of CCAP, suggesting that firms create new skills by recombining their current capabilities or by finding unexplored potential of the current knowledge. Although having different terms, the concepts of "knowledge integration" (Grant, 1996a) or

"architectural innovation" (Henderson and Clack, 1990) are within the same line with combinative capability (Van den Bosche et al, 1999).

However, Grant (1996a) claimed knowledge integration consists of two dimensions: adding new types of knowledge and reconfiguring existing knowledge. Grant argued that the flexible integration of knowledge can be processed either extending existing capabilities to encompass new knowledge, or reconfiguring existing knowledge within new patters of integration. He included the function of knowledge exploration in knowledge integration by including one more dimension, adding new types of knowledge. He thought that knowledge integration is not mere exploitation of current knowledge, rather the knowledge integration can offer a platform to acquire new types of knowledge and to combine them together. This is the same line with the argument from ACAP; learning new types of knowledge is function of both ACAP and the prior knowledge of the learner. That is, knowledge integration functions as the prior knowledge of the learner through linking the current knowledge with new types of knowledge. Analogues to the concept of knowledge integration, Carnabuci and Operti (2013) contended that two distinct types of recombinant capabilities are required: "recombinant creation" and "recombinant reuse". Specifically, recombinant creation requires a "capability broadening" exercise whereby firms experiment with unexplored interdependencies among other technologies; the recombinant reuse is a "capability deepening" exercise in which new technologies are derived by delving deeper into a firm's existing repertoire of combinations.

Here, the difference arises between two. Kogut and Zander see the concept of

CCAP as an organizational capability specializing in knowledge exploitation, but Grant and Carnabuci and Operti think of knowledge integration as the concept including both knowledge exploitation and exploration. According to Grant and Carnabuci and Operti, knowledge exploitation can proceed through reconfiguring existing knowledge while exploration can proceed through encompassing additional knowledge.

After careful examination of both ACAP and CCAP, I notice that the two capabilities share some similar dimensions when expanded. In terms of the reason for these extended concepts, scholars have extended these concepts to explain whole process of knowledge management, especially the process that explored knowledge turns out to be exploited. However, in the early stage, each concept failed to explain the other dimensions of knowledge management that a firm processes, so the scholars broadened each concept, as an effort to explain the other dimensions of knowledge management which original concept had untouched. Despite of scholarly efforts to explain the knowledge management process by extending the original concepts, it is not only difficult to explain the integrated process of knowledge management, but also ambiguous to distinguish the boundaries of original concepts and their focal points. Similarly, Lichetenthaler and Lichententhaler (2009) criticized that the knowledge management research is often limited to specific parts of knowledge process such as knowledge creation or exploitation (Grant, 1996a; Nonaka et al., 1994). Moreover, they argued that integrative perspective is required to explain whole knowledge management process of the inside and outside of the firm, complementing the concept of ACAP.

Therefore, the contribution of the paper lies in helping to understand the evolutionary process of knowledge management inside of the firm, especially the process that knowledge exploration turns into exploitation. To investigate this process, firstly, this research attempts to distinguish the differences and similarities of two concepts, and to examine the relationship between the ACAP and CCAP based on the similarities. Then, based on the investigated characteristics, the research offers a framework to explain the gap between exploration and exploitation at the organizational capacity level by combining both ACAP and CCAP. In this paper, this integrative knowledge management process was regarded as the management process of knowledge recipient, especially the process that acquiring knowledge from outside and utilizing this knowledge. Therefore, I position this research in the extended line of knowledge transfer. Moreover, by connecting this dynamic process of organizational learning with the firm's growth stage, the research looks into what kinds of capabilities in the framework are dominantly utilized and elicits some propositions at each stage of firm's evolution. Lastly, to illustrate the evolutionary organizational learning with the two capabilities, this research offers longitudinal case studies of Korean steel producers.

3. Integrative perspective of knowledge management

3.1 Distinction between RACAP and RCCAP and its bridging role

Zahra and Gorge's re-conceptualization of ACAP extended the scope of operationalization and categorized the function of ACAP into two parts: Potential absorptive capacity (PACAP thereafter) and Realized absorptive capacity (RACAP thereafter). While PACAP is more involved in the learning ability which consists of abilities to explore, evaluate and assimilate the outside knowledge, RACAP is more involved in the utilizing the acquired knowledge through transformation and exploitation. On the other hand, the concept of CCAP is also extended and categorized into two parts: combining with new knowledge (recombinant creation) and reconfiguring the existing knowledge (reconfiguration) (Grant, 1996; Carnabuci and Operti, 2013). Interestingly, extending their own dimensions, both ACAP and CCAP share some characteristics each other- especially RACAP (Zahra and George, 2002) and recombinant creation (Grant, 1996; Carnabuci and Operti, 2013). Therefore, recognizing similarities and differences between two concepts will clarify the characteristics and the important dimensions of the two concepts.

Absorptive capacity	Combinative Capability
RACAP (Realized Absorptive Capacity)	**RCCAP** (Recombinant Creation Capability)
• Extending knowledge scope by adding transformed knowledge • Bisociation	
• Bisociation occurs within current cognitive structure • Efficiency perspective for profit creation (Lane, et al., 2006) • Bissociation → reification (Lane, et al., 2006)	• Bisociation occurs in a way of destroying current cognitive structure • Considering hidden potential of the knowledge for future use • Bissociation→ better understanding for the fragments of knowledge (Lane, et al., 2006)

[Table 1] similarities and differences between RACAP and RCCAP

Through an examination of prior studies, two similarities shared by RACAP and recombinant creation (RCCAP thereafter) are identified: first, both RACAP and RCCAP involve extension of the organizational knowledge scope by adding transformed new knowledge. Second, both go through bisociation process when handling the knowledge.

Zhara and George (2002) mentioned that "*transformation denotes the firm's ability to combine existing knowledge and the newly acquired and assimilated knowledge"*. In terms of recombinant creation, Grant (1996a) insisted that *"the innovation for sustained competitive is through extending capability with combining new knowledge with existing knowledge"*. Within similar vein, Carnabuci and Operty (2013) also mentioned that *"firms may vary in their ability to envision and create combinations using technologies that they have never combined before"*. Thus, it can further support what Carnabuci and Operti (2013) mentioned as *"technology that they have never combined before*" is the new external knowledge.

In regard to RCCAP, all the three comments indicate adding new knowledge based on current existing knowledge. Moreover, transformation is required to add new types of knowledge into current knowledge. This similarity comes from the determinant of both ACAP and CCAP. The scholars who are interested in ACAP and CCAP think that learning capabilities are function of prior knowledge and current knowledge level of the firm. So, although the external knowledge is idiosyncratic, the firm transforms the idiosyncratic external knowledge into the knowledge which can be easily understood with their current knowledge. That is, the transformation of new knowledge occurs in a way of finding a linkage with the existing knowledge. Moreover, through this process, the scope of organizational knowledge can be broadened based on the current knowledge structure. Therefore, I conclude that RACAP and RCCAP extend the scope of organizational knowledge based on their current existing knowledge by adding new knowledge into the current knowledge base through transformation.

Then, how does this process occur? Here, I find another similarity between two concepts; knowledge bisociation is preceded to attain this process. Bisociation refers to disassembling whole set of knowledge into many knowledge fragments. That is the fundamental process involved in the knowledge transformation. To explain bisociation of knowledge, it needs to look over the second assumption of the knowledge integration mentioned above; *"the knowledge is architectural knowledge whose specific components are integrated together in a coherent way (Henderson and Clark, 1990)"* In simpler terms, bisociation is the process of dissembling the whole architectural knowledge into small pieces.

Both of the concepts (RACAP and RCCAP) mention the importance of bisociation in regard to combining with new knowledge. In their paper in 2002, Zahra and George argued that "*breaking the knowledge into fragment should be preceded before transformation is going through"*. With this process, knowledge can be perceived or used for another usage, and integrated with the other pieces from new knowledge. Moreover, although CCAP does not mention anything about bisociation process of the knowledge, one of the assumptions which entail the knowledge integration shares similar process with bisociation of the RACAP. In terms of knowledge integration, architectural knowledge is the first assumption which enables to integrate different types of knowledge into more sophisticated knowledge. Defined as the innovation a firm, architectural knowledge is created by combining or integrating different types of component knowledge into new configuration (Boer, Van Den Bosch and Volberda, 1999). That means original knowledge should be broken into component knowledge to be combined with different knowledge or to be used in different ways. In similar vein, Grant (1996a) also thought that knowledge integration requires the architecture of capabilities. That is, moving up the hierarchy of capabilities, the span of specialized knowledge which can be integrated is broadened. Moreover, he mentioned the more specialized the knowledge is the more complex, and this complexity has more linkages to be extended and integrated. Based on his argument, it can be inferred that knowledge integration requires the architecture of capabilities which can break the complex knowledge into less complex pieces. Further, although specialized knowledge offers more rooms to be linked and utilized with the other knowledge, it also requires

interpretation process to find another usage. The process of interpretation is based on dissembling this complex knowledge into less complex components to make them easy to understand and associate with others. Thus, the knowledge integration should be preceded by bisociation. However, neither Boer et al, nor Grant connoted that this knowledge break process only belong to either combining with new knowledge or reconfiguring the existing knowledge. From this, another inference can be made; the process of disassembling knowledge is a basic condition for combinative capability rather than one condition for either recombinant creation or reconfiguration.

However, despite the similarities, the fundamental differences exist between the two concepts. One of the distinguishable differences is the extent to which knowledge transformation occurs. I claim that, although both capabilities involve some degree of change of the new knowledge, RCCAP is more in-depth than RACAP in the degree at which new knowledge changes. Actually, Zahra and George (2002) mentioned that it is required to reframe and change the existing knowledge structures during transformation process. However, Todoroba and Durisin (2007) argued that transformation and assimilation are not sequential process rather, they are more of an alternative process. That means, while assimilation occurs in a way that new types of knowledge are understood within current cognitive structure, transformation occurs in a way that new types of knowledge are understood in a way of demolishing current cognitive structure. Therefore, I argue that going through the assimilation process, which involved in PACAP, new knowledge is already understood or processed as a way of compatible

with current cognitive frames of organization. Analogous to this argument, I suggest that from long term perspective, transformation can follow assimilation. But when transformation of knowledge occurs, within PACAP, the knowledge already becomes assimilated knowledge which can be transformed at the extent which it can change the cognitive structure marginally.

On the other hand, the exercise of RCCAP is triggered to find new linkages or create new interaction with the other components (Henderson and Clark, 1990). So, knowledge transformation in utilizing RCCAP requires demolishing current cognitive structure intentionally. This would bear significant changes in cognitive structure so that it can interact with new types of external knowledge. Moreover, the change in cognitive structure can bring the association with totally different types of knowledge, and at that time the transformed knowledge can work as a platform where new types of knowledge can germinate or embed in the organization. In this way, transformation in recombinant creation plays a significant role on exploration in the assimilation of different kinds of knowledge.

For example, one electronic company, after assimilating computer production technology can transform the learned technology in more context specific way; this might include size reduction, change to the higher voltage or computer design. Through this transformation process, the company leverages its transformed knowledge more efficiently. In this case, they transformed the knowledge within the current cognitive structure. However, later, if the same electronic company finds that their semiconductor technology which is part of computer production technology can contribute to mobile phone production, they transform their

knowledge in a way of challenging their cognitive structure. In this example, the first transformation belongs to RACAP, whereas the later transformation belongs to RCCAP. Therefore, knowledge is disassembled more fundamentally when it comes to exercising RCCAP rather than exercising RACAP.

Secondly, in terms of RACAP, Lane, Koka and Pathak (2006) analyzed that

> *"Zhara and George (2002) focus on the concept of 'absorptive capacity efficiency'....*
>
> *While they are correct that "profits are created primarily through "RACAP" to "PACAP", defining absorptive capacity management in terms of an output/input ratio biases thinking toward the short term, since it ignores absorptive capacity's role in preparing for the future" (Lane, Koka and Pathak, 2006, pp855)*

Based on this argument, it can be inferred that RACAP ignores its role in preparing for future use of the knowledge, because of its emphasis on the efficient knowledge exploitation for profit creation. However, in terms of RCCAP, it attempts to find hidden potential for knowledge use for innovation. That means, although knowledge cannot generate huge amount of profits currently, since knowledge is retaind and does not disappear, these characteristics enables firms to rethink and reconsider about the use of knowledge. Grant (1996a) argued that the more complicated knowledge is, the more rooms to be linked and interacted with the others. However, it requires some level of organizational capacity which can

understand the architecture of the knowledge and utilize the knowledge for new type of knowledge integration. This means that an organizational capacity needs to be built up for understanding and utilizing of more sophisticated knowledge. It alludes that RCCAP focuses highly on its hidden use and potential of the knowledge. In that way, I conclude that RCCAP is relatively more related to the knowledge utilization for creating competitive advantage while RACAP is more involved in the knowledge utilization for profit maximization.

Lastly, although both concepts go through the process of bisociation, the next step after bisociation is quite different with each other. This difference is originated from the purpose of each concept. As mentioned as second difference, while RACAP is more involved in commercializing, RCCAP is more involved in finding hidden usages. After the bisociation, while RACAP requires reification process of the knowledge, RCCAP facilitates better understanding segmented knowledge. Again, if certain form of knowledge is to be transformed into other form or combined with other knowledge, it requires a decomposition stage which dismantles the construct of knowledge into several fragments. This is the bisociation process which RACAP and RCCAP share in common. However, after this step, RACAP requires reification process which specifies and constructs the knowledge to turn the transformed knowledge into exploitation process. On the other hand, RCCAP aims to develop new knowledge, so the reification can be problematic. According to Cronbach and Meehl (1955) for concept construct, reification is problematic because it limits the validity of studies that use the construct for. Similarly, Lane et al (2006) claimed that developing new knowledge requires understanding all of those facets of

concepts. In this regard reification can hinder the development of knowledge into many ways. Analogous to these, RCCAP should facilitate precise understanding of all of the knowledge fragments to find another knowledge combination.

Careful investigation of two concepts enables to understand what their original differences and focal points are and how each capability can be used to explain firm's organizational learning more systematically. Furthermore, based on the similarities, the research can infer that although ACAP and CCAP have different focal points in terms of knowledge, - ACAP is related to knowledge transfer, but CCAP is more related to knowledge integration- they share some characteristics which contain the other's perspective. This means that the overlapping part of two concepts acts as a bridge between ACAP and CCAP. Therefore, this paper argues that based on the shared characteristics of RACAP and RCCAP, ACAP and CCAP can be combined with each other. In the next section, we will discuss how the combined framework consists of, and how it can explain the dynamic process of knowledge management at organizational capacity level.

3.2Combining framework of ACAP and CCAP

This section offers a model that combines ACAP and CCAP based on the characteristics shared by both RACAP and recombinant creation. This model depicts how an organization processes knowledge management procedure, starting from knowledge exploration to exploitation. This model is based on the dynamics of

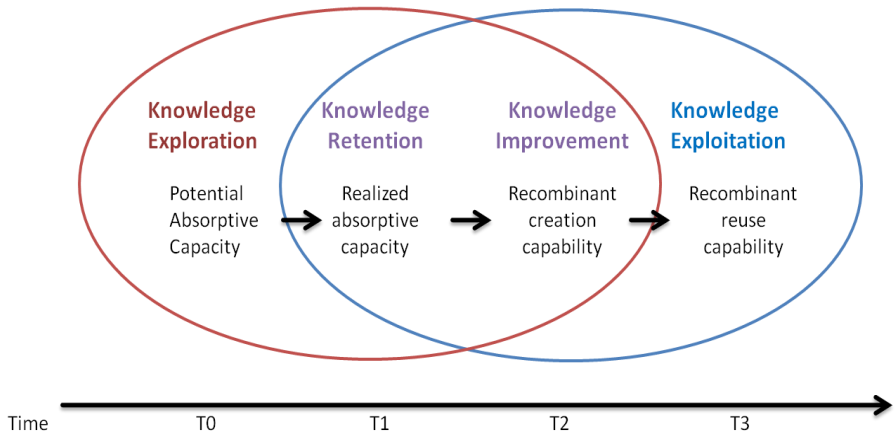
learning at the organizational capacity level. A basic assumption of the organizational learning is that learning starts from individuals not from organizations (Nonaka & Takeuchi, 1995) but, in this paper, I establish the knowledge process and learning at organizational capacity level as the scope of the research. So, one hidden premise is that organizational learning developed as three inter-level ways- starting from individual through group to organizational level (Crossan, et al., 1999). Although this paper does not deal with how these inter level learning affects on the evolution of knowledge capacity at organizational level in this research, I acknowledge that this inter level learning process occurs at each stage of capacity building process, and definitely is required, when evolving or going step further to next stage of capacity.

Most scholars intriguing in organizational learning consider that firm's technological innovation and development are the result of organizational learning process (Cohen and Levinthal, 1990; Kogut and Zander, 1992; Grant 1996a; and Zhara and George, 2002). Therefore, in this research, I assume that as a firm accumulates its knowledge, they could build up their technological ability to utilize and to innovate. Further, to explain the process in which the firm's capability can develop as acquired knowledge is exploited I consider a firm's learning capacity with the dynamic capability approach (Zollo and Winter, 2002). It insinuates that learning capacity of the firm can be developed and modified into higher level of capacity. Dynamic capability is defined as follow.

"a dynamic capability is the capacity of an organization to purposefully create,

extend, or modify its resources base (Helfat et al,. 2009, p.4)"

As assumed in organizational learning and dynamic capabilities research (Kogut and Zander, 1992; Helfat et al., 2007), knowledge consists of know-how and information (Lichtenthaler and Lichtenthaler, 2009). Know-how refers to accumulated skills and expertise, while information refers to the fact that may be codified.



[Figure 1: combined framework of ACAP and CCAP and knowledge process management within firm]

[Figure 1] attempts to show how the organizational learning capability changes in accordance with knowledge management process. This attempts to depict whole process starting from knowledge exploration to exploitation within firm. As [Figure 1] suggests, this research argues that the process from knowledge exploration to exploitation consists of four stages: knowledge exploration, retention , improvement and exploitation. Specifically, this framework suggests what organizational capabilities are involved in each process of knowledge management: PACAP to

exploration, RACAP to retention, RCCAP to improvement, and RUCAP to exploitation. As the capability develops from PACAP to RUCAP, the degree in which knowledge bisociation occurs is enhanced, and the utility of knowledge becomes more diverse and flexible. Here, I assume that the relationship among the learning capabilities is continuous rather than dichotomy. That means, although one capability can be more determinant on the certain process, all of the capabilities are interactive and required in all stages.

Knowledge exploration refers to acquiring external knowledge from outside (Lane et al., 2006). In this paper, this is the starting point of knowledge management process of the firm, and PACAP is more dominantly utilized in that process. Knowledge retention results from the need to manage knowledge for over time (Garud and Nayyar, 1994). That is, knowledge retention requires making the knowledge active by continuously utilizing it (Lane et al., 2006). This time, RACAP enables the knowledge to be active by marginal transforming and applying it commercial ends. Interestingly the knowledge has different characteristics from those of Recardian rents; as the knowledge is utilized, its utility and productivity do not decrease. This is derived from the difficulty of appropriability which knowledge has as a characteristic (Grant, 1996b). As Grant mentioned, knowledge can be sold without losing it. Analogous to this, knowledge can be reutilized either to make new types of knowledge or to apply commercial ends, as long as it is not lost within the boundary of knowledge holders. That is, as long as utility of knowledge is remained, the organizational capability can reactivate and synthesize the knowledge with additional knowledge (Pandza and Holt, 2007). However, these reactivation and

synthesis require the bisociation of the current knowledge at a deeper level. Reactivation and synthesis need to destroy the usefulness of the current knowledge for the firm and to disassemble the firm's current cognitive structures and the routines into fragments so that the organization can find hidden linkage with the other types of knowledge. Considering that routines and cognitive structure of organization are deeply embedded in the organizational structure and process, it requires more fundamental destruction which is difficult for firms to identify (Handerson and Clark, 1990). In that sense, whereas RACAP is the knowledge retention process which focuses on maintaining knowledge, RCCAP can be regarded as the knowledge improvement stage which focuses on transmuting the characteristics of knowledge fundamentally in order to reactivate. The knowledge which is disassembled into fragments has a linkage to connect with the other kinds of knowledge. This unique characteristic of knowledge enables a firm to use knowledge repeatedly as a way of improving the boundary of organizational knowledge. In the case of the electronic company mentioned above, the knowledge can function as a platform which enables to explore and acquire other knowledge with an effort to reactivate knowledge. In that sense, RCCAP enables the current knowledge to act as a platform to acquire other types of external knowledge. Lastly, knowledge exploitation refers to the replication of new approaches in diverse context with different settings (Zollo and Winter, 2002). In this stage, RUCAP is dominantly used, and focuses heavily on reconfiguring the current knowledge fragments in coherent way in order to find hidden potential for future use.

[Table2] shows the characteristics of each dimension in the combined frame work

and what organizational abilities pertain. This chapter will discuss the dimensions of each capability in accordance of exploration, retention, improvement, and exploitation procedure.

Knowledge Exploration	Knowledge Retention	Knowledge Improvement	Knowledge Exploitation
Absorptive capacity		Combinative capability	
PACAP (Potential Absorptive Capacity)	RACAP (Realized Absorptive Capacity)	RCCAP (Recombinant Creation Capability)	RUCAP (Recombinant Reuse Capability)
•Recognize •Assimilate	•Maintain •Transform	•Transmute •Reactivate	•Integrate •Generate
•Ability to recognize the value of knowledge • Ability to assimilate the recognized knowledge	•Ability to maintain by utilizing knowledge • Ability to transform the knowledge within cognitive structure	•Ability to fundamentally transform the knowledge • Ability to revive by combining with new knowledge	•Ability to combine among existing knowledge •Ability to consider hidden potential for future use

[Table 2: Dimensions of combined framework]

- **Knowledge exploration: Potential absorptive capacity (PACAP)**

In the broad scope of knowledge process management of knowledge recipient, PACAP is the knowledge exploration stage. This stage mainly determines the firm's action about what external knowledge an organization will assimilate based on the exploration of external knowledge. Zahra and George's (2002) definition of PACAP emphasizes on the firm's ability to explore, assimilate and applying external knowledge. Interestingly, in the study of Zahra and George (2002), the ability to recognize value was omitted. Rather the acquisition of new knowledge was introduced as one dimension of PACAP. However, I argue that reintroduction of ability to recognize value is more suitable to highlight the role of PACAP, when

explaining knowledge management process of recipient.

This rationale derives from two reasonings. First, it is directly related to the decision of knowledge sources in knowledge transfer process. Among the external environment knowledge, the knowledge recipient has to decide what kinds of knowledge they get transferred from whom. This decision process brings more fundamental questions about the purpose and channels of knowledge transfer to the organization. While handling these questions, the recipient can recognize not only the value of the knowledge itself, but also the value of transfer process such as the sender's characteristics, and channels. In this regard, the ability to recognize value of knowledge can include the ability to recognize value of context of knowledge transfer. Since the context of knowledge transfer can affect on the quality of knowledge transfer (Gupta and Govindarajan, 2000), the ability to recognize value is the receiver's capacity in finding suitable knowledge and protecting knowledge during the knowledge transfer. Second, the firm often fails to absorb new external knowledge because of their embedded knowledge base, rigid capabilities, and path-dependent managerial cognition (Gavetti & Levinthal, 2000; Helfat, 2000). This means that the valuing knowledge is neither automatic nor objective. In reality, it is biased and sometimes distort, therefore, it needs to be fostered to recognize the value of knowledge more accurately (Todorova and Durisin, 2007). This is in the similar vein with what Cohen and Levinthal (1990) referred to absorptive capacity.

Another dimension of PACAP is assimilating this recognized knowledge into firm's knowledge base (Lane et al., 2006). This refers to the knowledge receiver's ability to acquire and learn external knowledge, and the ability to incorporate this

knowledge into firm's knowledge base. While this process, the existing cognitive structure does not change, and the external knowledge is "assimilated" within the current cognitive structure level (Todorova and Durisin, 2007). At that time, the external knowledge might be slightly altered to fit into the current cognitive structure, but this alteration is hardly regarded as transformation.

The dimensions of PACAP deeply involves with the process of knowledge exploration of the firm. In similar vein, Cohen and Levinthal (1990) indicate that ACAP is a funnel that emphasizes exploratory learning. Here, in this paper what I mean by PACAP resemble the concept of ACAP which Cohen and Levinthal argued. Therefore, I can conclude that PACAP focuses highly on exploratory learning of the firm. However, as Lichtenthaler and Lichtenthaler (2009) argued, PACAP does not guarantee successful knowledge utilization of acquired knowledge, because this PACAP focused on knowledge exploration process. Therefore, in order to explain the whole process of knowledge management within firm's boundary, the elaboration of the capabilities which involve in the other processes are required.

- **Knowledge retention: Realized Absorptive capacity (RACAP)**

Knowledge retention follows the stage of knowledge exploration in knowledge process management within organizational boundary. Knowledge retention requires firm's effort to maintain its knowledge internally (Garud and Nayyar, 1994). According to Campbell (1960), firm can keep its knowledge alive by continuously utilizing its knowledge or assigning its resources to knowledge. Although Campbell identified two ways of knowledge retention, I assume the former one as knowledge

retention while the latter one as knowledge improvement. This is due to the fact that assigning its resources to knowledge requires different types of organizational effort, such as analyzing suitable resources and matching the resources with knowledge in coherent way. In this regard, RACAP involves in maintaining knowledge by continuously transforming and utilizing it for commercial ends.

Since PACAP itself does not guarantee management of acquired knowledge, the firm requires building up another type of organizational capabilities, which maintain the acquired knowledge and make it commercial ends. So as second stage of the knowledge management process, the framework focuses on the firm's ability to maintain and transform the newly acquired knowledge. Although the concept of RACAP is based on what Zahra and George referred to, RACAP developed in this paper own a different dimension: maintain the knowledge. This is because this paper suggests that knowledge can be utilized in various ways as time goes by. That is, while Zahra and George focused on the process of knowledge management from acquisition to commercialization as one time process, this paper focuses more comprehensive process of knowledge management in the firm. So this paper assumes that knowledge is not worn out after using it for commercialization, rather the frequent use of knowledge contributes to the maintenance of the knowledge (Szulanski, 1996). In this regard, exploiting newly assimilated knowledge for commercialization is more involved in the dimension of maintaining knowledge.

While RACAP is exerted, newly acquired knowledge goes through lower level of disassembling process for transformation of the knowledge. In this level, the extent to which knowledge transformation occurs is marginal and within the current

cognitive level. Firstly, this transformation occurs to create more profit from the knowledge commercialization process. So, as essential part of knowledge is remained, only marginal part of knowledge is transformed in order to advance its value as a commercial product. Moreover, the disassembled part in knowledge also has to undergo the reification process which elaborates the knowledge more in details to make it commercial ends. In this regard, the transformation in RACAP enables the firm to maintain the knowledge through exploitation for profits (Lane, Koka, and Pathak, 2006), and the level of knowledge bisociation should be marginal. Moreover, since the knowledge is quite new, organization might be in difficulty in disassembling this newly acquired knowledge thoroughly by active learning. Therefore, I infer that knowledge bisociation is at the starting stage.

For these reasons, RACAP is the firm's capability to retain its knowledge in early stage. As the firm develops its capacity by more aggressive learning, its further effort to improve its knowledge leads to RCCAP.

- **Knowledge improvement: Recombinant creation capability (RCCAP thereafter)**

Knowledge improvement is the stage at which the firm assigns its resources to the knowledge or the firm extends its knowledge scope based on the current knowledge fragments. As mentioned above, Campbell (1960) claimed that knowledge retention can be achieved through two ways: continuously utilizing its knowledge or assigning its resources to knowledge. However, I argue that assigning firm's resource to knowledge is more related to knowledge improvement, and this process

should precede combining with new knowledge. Here, firm's resources can be any capabilities or any organizational efforts including analytic skills, challenging current thought and process to innovate. These organizational resources enable deeper level of knowledge bisociation and gives opportunity to find new linkage among seemingly different types of knowledge. Through this, the firm can reactivate and synthesize the knowledge with additional knowledge (Pandza and Holt, 2007). That is, although the utility of knowledge for commercial ends decreases, its utility as a platform for new knowledge can be reactivated through RCCAP. In this regard, RCCAP is the firm's organizational capability which transmutes the characteristics of knowledge more fundamentally and revives previously acquired knowledge by combining with new additional knowledge.

At this level, the firm should attain two objectives to exercise RCCAP effectively: first, it disassembles the knowledge more detailed components through more rigorous bisociation. Second, the organization should understand each knowledge component lucidly. To attain these, the organization requires more active learning that advances the level of knowledge bisociation. After achieving the former, the firm can exert its RCCAP more properly. Through RCCAP, the previously acquired knowledge (can be referred as prior knowledge) can act as a platform to integrate new knowledge within firm (Grant, 1996a). This is what we call as recombinant creation. Since recombinant creation requires higher levels of knowledge bisociation to find a linkage with the other knowledge and combine them together, this research sees the capacity required to this as a subset of CCAP. The reason why RCCAP is a subset of CCAP rather than a subset of ACAP lies in its emphasis on

combination of the knowledge. Although both RCCAP and RACAP broaden organizational knowledge scope, RCCAP can attract more different types of knowledge than RACAP can. Moreover, while RACAP attract new types of knowledge which can be applicable in current cognitive structure, RCCAP can attract idiosyncratic knowledge which requires modification of cognitive structure. This shows that RCCAP enables knowledge integration more in flexible and broadened way. However, RACAP attempts to transform assimilated knowledge, this assimilated knowledge takes some time to be understood as disassembled fragment. It means, although the knowledge broadening exercise occur through the transformation process, still the assimilated knowledge is central to combining with new knowledge. Therefore, this new knowledge which is integrated through exercising RACAP would be highly relevant to the assimilated knowledge. However, when it comes to exercising RCCAP, the disassembled fragments are the central to knowledge integration, and its focus on knowledge fragments can offer more opportunities to attract new types of knowledge. Grant (1996a) argued that the more complicated knowledge is, the more it offers the linkage with the other knowledge. Because the more complicated knowledge consists of various types of knowledge fragments, if knowledge integration occurs based on the knowledge fragments, every fragment can offer foundations to attract more diverse knowledge. In the similar vein, Stuart and Podolny (1996) posited the argument that organizations search for novel technologies in areas that enable them to build up their established technological base. Therefore, exercising RCCAP offers the opportunity to explore other new knowledge, while improving the value of existing

knowledge as knowledge platform. Therefore, RCCAP is more advanced organizational capability in that it contributes not only to improving the value of prior knowledge but also to exploring new types of knowledge with knowledge fragments from prior knowledge.

- **Knowledge exploitation: Recombinant reuse capability (RUCAP thereafter)**

As a firm accumulates and extends its knowledge scope to a certain degree, the firm attempts to reconfigure its knowledge in different ways to create new types of knowledge. This is what is referred to as recombinant reuse. In broad scope of knowledge management, recombinant reuse can be the knowledge exploitation exercise which encompasses the reification of new approaches and their application in diverse contexts (Zollo and Winter, 2002). As an exploitation process of knowledge management, recombinant reuse refers to firm's effort to refine and improve known technological combinations to discover new combination of knowledge (Carnabuci and Operti, 2013). In this regard, the firm is required to develop an organizational capability which delves deeper into a firm's existing knowledge, synthesizes and applies the knowledge to create new knowledge (Kogut and Zander, 1992; Grant, 1996a; Carnabuci and Operti, 2013). This is what we called as recombinant reuse capability (RUCAP). RUCAP is usually utilized to generate innovation through creating unique knowledge from firm's existing knowledge level. In that sense, this capability is similar line with architectural innovation (Henderson and Clark, 1990) which reconfigures the components of

existing knowledge in a new way.

Although RUCAP belongs to knowledge exploitation in broad scope of organizational knowledge management process, exercising RUCAP often requires exploration and transformation process internally. In the beginning, the firm has to explore the new usage or hidden linkage among the knowledge available in the firm. Moreover, although the firm finds potential linkage among the different types of knowledge components, it often has to change these components in mutually applicable way. So this process usually requires time and more intensive effort to create new types of knowledge (Lichtenthaler and Lichtenthaler, 2007). Moreover, it does not occur in abstraction from a firm's knowledge base (Kogut and Zander, 1992). In this regard, abundant knowledge scope should be available both as ingredients of knowledge creation and as a motivation to seek internal knowledge usage. Simon and Lieberman (2010) argued that firms are less likely to seek external knowledge when internal knowledge is available. Thus a company needs sufficient prior knowledge not only to utilize the knowledge but also to encourage this type of knowledge creation (Kogut and Zander, 1992) and time because an innovation exceeds a mere idea (Burgelman and Rosembloom, 1989). Therefore, exercising RUCAP is more advanced than exercising any other types of capabilities mentioned above.

Although I suggest that the knowledge reconfiguration process is the last step of the framework, the created knowledge and capabilities through these steps can become the prior knowledge which can bring new types of knowledge in the future. Moreover, while finding the hidden potential of the knowledge, the organization

would be encouraged to find any types of external knowledge which are deeply related to its newly created knowledge through reconfiguration. This is because the process of organizational learning continuously evolves as long as the firm exists. Within a similar vein, Van den Bosch et al (1999) suggested that combinative capabilities can be considered as a determinant of ACAP. Indeed, the scope of organizational knowledge which has been extended and deepened through the exercises of these capabilities is likely to function as firm's embedded prior knowledge. So it can be the determinant of new type of ACAP, which acquire and assimilate new types of knowledge. Therefore, as long as the firm evolves, the knowledge scope will be deepened and extended by taking these steps repeatedly.

4. The evolution of knowledge capacities and firm

4.1Methodology and Research setting

Here, the research advances the combined model introduced in previous chapter by connecting each dimension of the combined framework with each stage of firm's growth. It elaborates the argument that the learning capability of a firm should vary in accordance with the firm's growth stage. The discussion indicates that the each of four capabilities which construct the combined framework is dominantly exerted

and contributes to firm's growth at the different stages of the firm's growth.

This research constructs the discussion by combining the theory and empirical study together. To illustrate, the theoretical explanation and empirical case are elaborated together, but the empirical case study that I have researched follows the theoretical explanation. The adoption of this approach is largely a function of the research questions that this research is trying to figure out; 1) How the organizational learning of the firm have dynamically varied based on the two concepts of "absorptive capacity" and "combinative capability". 2) Which capability (absorptive capacity or combinative capabilities) are more utilized at each stage of the firm's growth. Specifically, the empirical study is based on longitudinal case study. Longitudinal case studies can presumably do a good job of revealing the very processes and mechanisms in which the firm and their environment co-evolve, and the particular circumstances and contingencies when these mechanisms operate (Huber and Van de Van, 1995). For the longitudinal case study, this paper analyzes the learning process of POSCO, Korean largest steel maker, from its establishment to the present (to 2009). The technology for steel production is relatively distinguishable in terms of level of technology advancement, so it can illustrate the development of capability level lucidly. In terms of data collection, I gathered all kinds of secondary data related to the research, which included the history book published by POSCO, periodical article, previous research papers related to the topics, and articles in journal and newspapers. Moreover, I gathered some organizational information by interviewing the employees to observe organizational effort for innovative knowledge creation. To observe dominance of learning

capability according to firm's growth and, the history of POSCO is divided into four categories. To do so, this research adopts the five-stage model which divides the life of a firm into five stages: birth, growth, maturity, revival and decline (Miller and Friesen; 1984; Lester, parnell and Carraher, 2003). Although there are many different models which explain the life cycle of the firm, this model is more applicable than the others in that it can be generally applicable for all organizations regardless of their size (Lester et al., 2003). Therefore, based on the five-stage model, the history of POSCO is divided into four stages of the five-stage model: Existence stage (1970-1979), Survival stage (1980-1989), Success stage (1990-1999), and Renewal stage (2000-2009)

However, in this research, I omitted the decline stage and focused purely on the four stages of the firm's growth. There are two reasons why the decline stage was omitted for this research; first, the scope of research in this paper is only the growth and evolution of the firm with their knowledge management process, so it does not consider the decline or degrade of the firm as a scope of research. Second, the researched firm in this paper continues to be exists and evolved, so it also cannot account for any findings empirically. Therefore, it discusses which organizational learning capability is strategically important and dominantly utilized at each four stage of the firm's growth.

4.2Case study

- **Existence stage (Late 1960s -1979)**

Known as birth stage (Lippitt and Schmidt, 1967), or creative stage (Greiner, 1972), this stage marks the beginning of organizational development (Lester, et al., 2003). Organizations in this stage tend to create their own environment through considerable innovation in production lines (Miller and Friesen, 1984). Here, what referred as considerable innovation or creation would be to determine firm's functional emphasis that will focus on in the commercial market (Scott and Bruce, 1987). This feature is most critical in that it determines the context of knowledge the firm explores and assimilates.

As soon as the firm decides the functional emphasis it constructs in the industry, it starts the exploration and evaluation activities to choose what kind of knowledge they will assimilate. Relatively, in this stage, acquiring knowledge from the incumbent of the industry is easy because the firm is recognized as the inferior than incumbents of the industry. This reasoning is even analogous to the International Product Life Cycle (Vernon, 1979). At the early stage of firm's development, the interests between newly established firms and the industry incumbents can co-exist each other. Because the technology and the knowledge the starting firm requires are relatively not sophisticated, and the starting firm usually adopts single production line. Pursuing more advanced technology, the industrial incumbents need the others which can take over the previous technology, and export inferior products to the starting companies. So among many types of external knowledge, the starting firm has to handle some kind of decisions related to knowledge transfer, including where, what, and how to acquire the knowledge. That is, when starting business, the firms

need to identify the value of the external knowledge, and embody specific context related to knowledge acquisition. This task can lay in the same line with “creating (Bedeian, 1990)” its own environment. After, the firm needs to assimilate identified knowledge. The level of accomplishment in the assimilation depends on how well the firm elicits and replicate the external knowledge from the incumbents. To assimilate knowledge more efficiently, the starting firm needs some technological understanding enabling to assimilate knowledge. This can be the prior knowledge (Cohen and Levinthal, 1990; Zahra and George, 2002), or basic product capability to replicate and prepare for technological innovation (Bell et al., 1995).

When POSCO started its steel production in early 1970s, POSCO pursued a growth strategy, which entailed introducing the modernized facilities and the cheapest steel production technology and selling its products to the Korean domestic market. Their growth strategy in the early stage offered a blueprint to create its own environment. POSCO attempted to acquire and assimilate the low level of steel producing technology from other advanced steel makers especially from England, Germany, and Japan.

In terms of technology introduction from outside, POSCO sent their employees to abroad to acquire steel making technology from late 1960s, aiming at constructing construction of steel manufacturing facility, quick normalization of operation and expansion of steel production capacity. POSCO selected the knowledge providers according to the types of knowledge. From European steelmakers, the knowledge related to steel production, such as technology, facility, and plant, was transferred, while the knowledge related to know-how or managerial skills was transferred from

Japanese steelmakers. Dividing the knowledge providers according to the types of knowledge is effective, because the level of transferred knowledge in dependent on the context of knowledge, and the providers (Gupta and Govindarajan, 2000). Especially in terms of tacit knowledge transfer, it hugely depends on how closely the sender and receiver can interact (socialize) with each other (Nonaka, 1994). In this regard, Japanese steelmakers were the best options as knowledge providers which can socialize each other easily, considering geographical and cultural and social factors. This example supports the findings that the firm's ability to learn from another firm depends on the similarity of both firms dominant logics (Lane and Lubatkin, 1998). Moreover, the example shows the importance of PACAP in the early stage of knowledge management process. Knowledge recipient should facilitate the ability to recognize and identify the types of knowledge and the effective providers from the variety of external knowledge available, because the choice of knowledge recipient will affect the whole knowledge management procedures. While acquiring knowledge as a new entrant of the industry, the recipient firm suffers from the lack of related organizational knowledge and capability, the liability of newness (Stinchcombe, 1965). However in terms of POSCO, they could exploit the experience of Japanese steelmaker efficiently by learning knowledge which had been already refined through the trial and error learning of Japanese steelmakers. Therefore, they can take the advantage of newness (Posen and Chen, 2013): saving time and resources which might have been exploited for trial and error learning. According to the interviewee, in the early stage of POSCO's learning, they could exploit the advantage of newness by

positioning themselves as “student”, persistently asking the questions regarding the managerial skills and know-how, and even attempting to smell out the all of the atmosphere of the steel production. As a result, POSCO could reduce the errors while implementing the acquired knowledge. Although POSCO lacked of the prior knowledge related to steel production process, these efforts could enhance their relative absorptive capacity (Lane and Lubatkin, 1998) especially toward Japanese steelmakers.

From 1973 to 1978, POSCO attempted to develop its technology through learning from abroad and codifying their technology to standardize their steel production. When POSCO operated its 1st and 2nd Pohang facilities, it acquired the knowledge especially for steel mill construction and engineering technology. But when the 3rd facility was operated, POSCO was prone to acquire knowledge for operation efficiency and quality improvement. Interestingly, while assimilating the knowledge for steel production, POSCO also engaged in production activity. POSCO’s operation, during this time, was to exploit the acquired technology with partial improvement. However, its effort to knowledge transformation should be understood as one process of assimilating knowledge. Since the basic feature of starting stage that the firm’s main efforts hinges around the effort on profit making (Scott and Bruce, 1987), this action is the effort for profit making in starting stage rather than knowledge extension. Surprisingly POSCO sold the assimilated knowledge related to steel production to Taiwanese steel maker in 1975. Taiwanese steel maker was especially interested in the assimilation ability of POSCO: how POSCO could finish their 1st and 2nd steel mill construction earlier that as it had

been planned, and how POSCO normalized its operation unprecedentedly fast. This implies that even the high level of PACAP can act as a firm's competitive advantage which contributes not only the knowledge acquisition but also, profit creation.

Through this case study, I infer that the firm's ability to explore and evaluate the external knowledge is important and dominantly exerted in the early stage of the firm's growth. To be specific, three important features are summarized: 1) it is important to choose the best teachers that they can learn from depending on the types of knowledge to be acquired. 2) During assimilation process, taking the advantage of newness is decisive on the efficiency of knowledge assimilation. And 3) PACAP can contribute to both firm's knowledge acquisition and profit making. In conclusion, it can argue that

Proposition 1: At the birth stage of the firm, Potential Absorptive capacity is dominantly exerted to identify and assimilate external knowledge.

- **Survival stage (Late 1970s – 1989)**

Referred to as the growth stage (Scott and Bruce, 1987; Lester et al., 2003) or survival stage (miller and Friesen, 1984), this stage refers to the pursuing growth and survival as a business unit. In this stage the firm potentially works as a business unit (Scott and Bruce, 1987), pursues growth (Adizes, 1979), and attempts to create its own distinctive competencies (Miller and Friesen, 1984; Lester et al., 2003).

Although the product line is normally single or very limited and the quality of the production is at the low-end in the market, the firm focuses on profit creation to

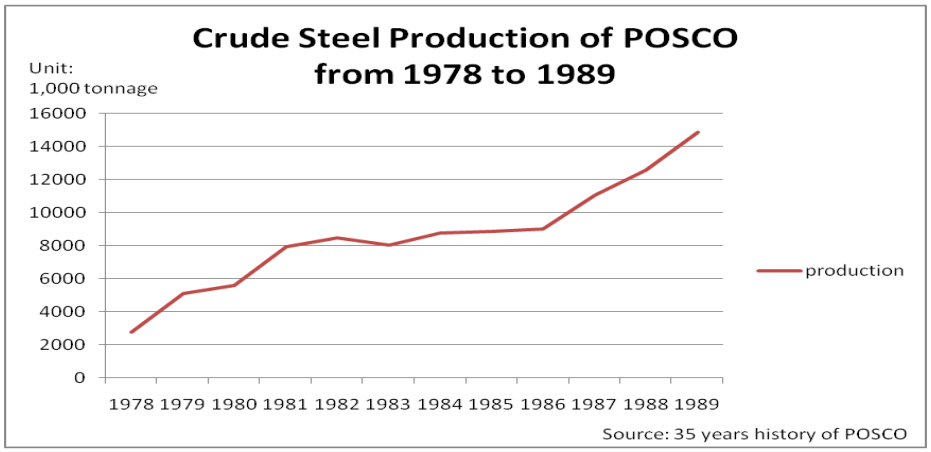
grow and expand their market segments. So, the goals of the organization are formulated, and the primary goals are usually to generate enough revenue to continue operation and suffice growth to stay competitive (Lewis and Churchill, 1983). In terms of organizational learning, usually the process going from PACAP to RACAP occurs through production process. Moreover, with the primary goal of profit generation, some of the modification to improve the quality and quantity of products can be achieved through transformation process of PACAP. In this time, the organization can develop minimum level of learning capability to make the knowledge transformed into applications-based adaptations (Arnold and Thuriaux, 1997). This capability can contribute to the incremental innovation, because it is more likely to be a slight transformation of the acquired knowledge for better efficiency or better quality to generate more profit. But, due to the desire of extending their product line, the proportion of PACAP still remains important.

After going through the birth stage, POSCO accelerated its own technological development aiming at increasing the output and embodying its fundamental competences. Especially because of the oil crisis in 1978, the advanced steel producers were reluctant to transfer their knowledge and technology to POSCO. Although the opportunity for technological transfer is lower, POSCO encountered a new opportunity to gain new knowledge from external sources. According to Lee (2011) the incumbent steelmakers tried to export their equipment and know-how to find a way out of the business difficulties (Korea Iron & Steel Association, 2005, p. 151). In 1982, POSCO launched the 5years plan for technological development with the goal of quality improvement and product differentiation. Starting from 1980,

with the demand of product diversity and differentiation, POSCO attempted to develop more value added steel production such as carbon steel and automotive steel sheets. With the new opportunities to exposure outer knowledge and their desire to expand the scope of products, POSCO introduced the team system to diffuse and effectuate learning process within organization. The employees who had acquired the external knowledge were assigned to each team to teach and diffuse the acquired knowledge to the other employees. Each team was also in charge of each part of steel production, and had to learn the knowledge and implement the acquired knowledge in real production. Each team had to deal with the problems appeared while processing their production part. Through discussion and trial-and-error learning, the team members struggled to find the solutions and the effective solutions were reported and presented to the all organization every time.

Although the team system was originally initiated to develop problem solving skills, it has been developed as a technology discussion session, while POSCO re-launched the 2nd 5years plan of technology development. Through the interview, I found that POSCO systemized more flexible atmosphere to give all members in the team rights to speak. Good ideas elicited from team discussion could be tested and implemented in real steel mill. Interestingly, POSCO offered a small steel mill where all the good idea can be tested in small scale before it is implemented in real steel production process. These efforts enabled POSCO to routinize the technology discussion session which encourages the knowledge transfer, share, and creation, and the technology discussion session is still currently contributing to its knowledge development. Furthermore, as a more rigorous effort to encourage R&D activities,

POSCO diversified the research related institutes under the strong willingness of CEO TJ Park. By saying that “You can import coal and machines, but you cannot import talent", POSCO established the Pohang University of Science and Technology (POSTECH) in 1986, and next year, it founded the Research Institute of Industrial Science & Technology (RIST). Through the diversification of the research related institution, POSCO established triangular cooperative relationship between industrial- educational- research institution. This trilateral R&D cooperation has enabled to achieve technological leapfrogging and remained still as the main R&D cooperation network of POSCO. Especially this cooperative R&D focused on developing processing technology for cost reduction and operational efficiency. As a result, by the late 1980s POSCO's growth had been immense. It was the fifth biggest steel company in the world with an annual production approaching 12 million tons in terms of crude steel production.



[Figure 2: Change in crude steel production of POSCO in 1980s]

Through scrutiny of the efforts for technological development in survival stage, I

infer that the firm's ability to diffuse and transform the knowledge is important. Moreover, the efforts to transform the knowledge are more likely to generate more profit by enhancing efficiency. In this regard, I conclude that the exercising RACAP is crucial in growth stage. To exercise RACAP efficiently, the organization has to 1) facilitate the organizational structure which can offer the knowledge diffusion and creation opportunity, 2) create the atmosphere which encourage all the employees to actively participate in knowledge transformation and actualize their ideas. Therefore, the proposition elicited in this stage is

Proposition 2: At the survival stage of the firm, the importance of RACAP increases in order to pursue operational efficiency, but it should follow the systemic support at organizational level

- **Success stage (Late 1980s- 1999)**

Often called maturity stage (Adizes, 1979), the success stage is expected to follow growth as organizational structure is established and stabilized (miller and Friesen, 1984). During this time, the company has to cope with the enlarged scope of the product line, thereby heavy emphasis falls into administrative issues to control and co-ordinate the expanded and more diverse operation. Moreover the firm is recognized as one of the main competitors in the industry, and its varied competitive environment forces it to seek ways to maintain it competitive advantages. From this stage, the firm has to embark on formal research and development to expand and maintain their product range (Scott and Bruce, 1987). So, its strategic purpose puts

the emphasis on maintaining a competitive advantage for entire product lines. From then, the firm is greatly required to focus on customer needs and adapting the product offering to meet those needs. Moreover, the intensified competition often causes a more turbulent operating environment which in turn increases the need to be proactive and anticipatory (Scott and Bruce, 1987). This again calls for greater external emphasis and adaptation of firm's knowledge management. To deal with more turbulent competitive environment, the firm tries to acquire new external knowledge which enables them to be more proactive and anticipatory. However, due to not only the difficulties of acquiring knowledge but also lack of the external knowledge the firm can adapt, it attempts to new types of knowledge from other industries, and to adapt these industry-different knowledge to be more differentiated and competitive in the industrial competition. Here, the knowledge should be understood by distinguishing the context of the knowledge (Kim, 1998). Considering that the players who introduce new types of innovation or norms in the industry are more likely to become frontier of the industry, introduction of industry different knowledge can be seen as the firm's effort to pursue industrial frontier. This is because the firm seeks to break its path dependent behavior, find the source of competitive advantages, and set the new standard for the industrial competition by introducing industry-different knowledge.

In this period, POSCO strategically divided their steel production capacity into two areas: Pohang and Gwangyang. While Pohang focused on the massive steel production with the average quality, Gwangyang pursued more complicated and differentiated steel production such as stainless steel, and cold coil steel. Dividing

the facility for steel production can be seen as POSCO's effort to focus on maintaining the competitiveness of both products. Thus, through the expansion of Gwangyang's capacity, POSCO could pursue two strategic goals: first is to maximize the productivity of Pohang steel mill; second is to broaden its portfolio for high quality steel products while improving products quality. As the cold core steel became the main product of the steel production in 1990s, POSCO prioritized improving the quality of cold coil steel. To attain the competitiveness of cold coil products in terms of its quality, the company launched the innovation campaign at the firm level. So the technology discussion session more prospered throughout all the organization level. As a result, the Gwangyang facility developed new types of thickness controlling system (New AGC) which can be distinguished from the conventional technology (Conventional AGC) for cold coil steel production based on the knowledge shared at the company level. Moreover, to achieve the best practice of the steel production process, POSCO restructured its operational routines by incorporating the similar tasks together at the company level. This "Business Process Reengineering (BPR)" resulted in reducing the process especially in terms of production process management. Moreover, to minimize the quality discrepancy, POSCO introduced six sigma from GE and adapted it to the steel production process at the company level. Based on such effort, POSCO ranked as the top crude steel producer in the world in 1997.

However, POSCO was not satisfied with the results of competition in crude steel production. Although it was very competitive in crude steel production, its technology level was far behind from that of Japanese companies and other

competitors. Thus, POSCO became involved in another innovation to leapfrog its technological level. During this time, POSCO divided the trilateral cooperative relationship among POSTEC, RIST, and POSCO into two parts: research cooperation for process technology and for products development. While research of process technology dealt with technological improvement in upstream of the value chain and the innovation of processing, the research of products development focused more on the downstream of value chain, and products commercialization. The divided structure of R&D enabled R&D participants not only to broaden but also to deepen the knowledge scope at organizational level. POSTEC and RIST proposed research plans or ideas, and these ideas and plans could be examined and tested in terms of profitability and possibility for implementation in workplace. Then in the case the ideas were feasible, they were implemented as an output of knowledge creation. Moreover, POSCO attempted to broaden its knowledge scope as a steel production engineer. Although POSCO emerged as the major producers in world steel industry, it realized a need to participate in steel production engineering. Based on the steel production technology accumulated with knowledge transfer and transformation, POSCO attempted to learn COREX production technology from Voest Alpine which is considered as the best steel production engineering firm in the world. Later, this COREX technology functions as the fundamental technology which creates the FINEX technology, which makes POSCO the most competitive steel producers in the world.

Based on case study, this paper claims that in the success stage, RCCAP plays important role in introduction of new types of knowledge, making the hidden

linkage between firm's current knowledge and new types of knowledge. Especially to enhance competitive advantages of the firm, RCCAP contributes to acquire new types of knowledge in two ways: first, RCCAP can connect the new types of knowledge with current knowledge for quality improvement. Second, RCCAP can bring new types of knowledge based on current knowledge for pursuing different strategic goals such as diversification, extension of firm's business area. In terms of POSCO's case, while introduction of six sigma from GE is regarded as the knowledge acquisition for quality improvement, the introduction of COREX from Voest Alpine is seen as the knowledge acquisition for latter strategic goal. Based on the case study, I elicit some important feature from this case in developing RCCAP: first, the organization should facilitate the structure in a way of specializing each function of the organization; Second, the external knowledge providers can be expanded not only from the intra industrial competitors, but also to other organizations in other industries; and third, to develop RCCAP, the organizational strategy should be involved as a mean of knowledge expansion. Therefore, the research can conclude that

Proposition 3: *At the success stage of the firm, effective use of RCCAP functions as means of competitive advantage, but the firm's strategy and systematic change should be followed bydeveloping RCCAP.*

- **Renewal stage (Late 1990s – 2009)**

Termed as the revival stage (Miller and Friesn, 1984) or renewal stage, the

organization in this stage is encouraged to re-structurize and to broaden its scope of business to cope with a heterogeneous atmosphere. It follows the termination of larger divisionalized firms (Chandler, 1962; and Channon, 1973), and facilitates more sophisticated control and planning systems (Miller and Friesen, 1984) such as using the matrix structure or decentralized decision-making structure. These internal changes encourage workers to facilitate the creativity and autonomy for their work (Lester et al., 1984). In this stage, usually key issue facing management is finding new growth opportunity, because price competition has already been the basis of the success. Therefore, a major innovative thrust should be beyond the only cost control. The firm staying in this stage may shrink its operations (Scott and Bruce, 1987), but this is because normally the firm more cares about producing more technologically advanced products rather than merely production output. In this regard, organizational learning also encourages the workers to facilitate creativity, and find some ways to innovation. Because the organization in this stage shows a strong desire to return a learner time (Miller and Friesen, 1984), collaboration and teamwork are encouraged. To be in frontier position in the productivity frontier of the industry, rather than introducing the knowledge from outside, the firm attempts to create its own knowledge by reconfiguring its knowledge in different way. There are two reasons why firms are attempting to create its own knowledge: firstly, the external knowledge that the firms can acquire is rarely available, because they are already considered as major competitors in the industry, and most of the other companies are cautious about spilling over their knowledge. Second, the firms in the stage also have accumulated a high level of knowledge in terms of not only the

quantity, but also, the diversity of context as well. Moreover, their organizational capabilities have been mature enough to deal with both knowledge exploration and exploitation within the firm's boundary. Therefore, the knowledge creation within firm's boundary becomes feasible alternative to have what Schumpeter (1942) coined as creative destruction of firm's competitiveness.

Although POSCO became the leading industrial crude steel producer in 1997, it had to go through external and internal turbulent in early 2000s. First of all, the major players of the world steel industry attempted a vertical integration and aggressive M&A with their competitors as strategic choices[1]. Especially POSCO was vulnerable with excess capacity and the financial crisis hitting Korean economy the currency crisis hit the economy in late 1997. Moreover, the new government decided to privatize POSCO and by 1998, the South Korean government had reduced its ownership of shares in POSCO to less than 20%, and in 2000, full privatization of POSCO was completed.[2]

The turbulence incurred from external and internal environment brought POSCO a sense of internal crisis, and searching new opportunity to innovate itself. Strategically, POSCO focused heavily on exploring new opportunity to generate profits not only as a steel producer but also as steel production engineers. One of the

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[1] [1] 포스코 경영연구소 [세계 철강기업의 경쟁력현황과 요인분석 –M&A효과 분석을 중심으로]
http://www.posri.re.kr/PosriReport/Report/reportView.asp?intSearchType=&strSearchWord=&orderBySel=&strId=630&page=&pubCode=0001001

[2] Wikipedia: [POSCO] http://en.wikipedia.org/wiki/POSCO 20130606 accessed.

results among these efforts is its first commercialization of FINEX steel making process. To be specific, FINEX is the steel making process which produces molten iron directly using iron ore fines and non-coking coal rather than traditional blast furnace methods through sintering and reduction with coke. While inventing this process, POSCO utilized COREX production technology acquired from Voest Alpine, and eliminated preliminary processing in the technology. These efforts required modifying and reconfiguring existing knowledge within firm boundary. To achieve this, POSCO fully exploited more autonomy to technology discussion teams in order to generate creative ideas. These technology discussion teams could freely interact with their own suppliers and consumers in terms of knowledge transfer and discussion without any hierarchical authorization process. Moreover, by introducing the online learning community and question arena for technology, POSCO attempted not only to share the knowledge acquired from each team but also to combine the knowhow and information together. Through these efforts of knowledge sharing and combining, POSCO was able to invent the FINEX steel production technology.

However, while commercializing FINEX stage, POSCO broadened its scope of knowledge share and combination up to the subsidiaries. When it comes to new type of facilities and the method of plant establishment process, POSCO was able to combine steel production knowledge with the high level of knowledge POSCO E&C owned about the plant construction. This combination with the subsidiaries resulted in the invention of the plant establishment method which makes the plant for FINEX less expensive to build than a blast furnace facility of the same scale.

Moreover, with the cooperation of POSCO Energy, FINEX enabled for the reduction of the pollutant exhaustion such as SOx, NOx, and carbon dioxide, and this led to cost reduction, pollutant exhaustion reduction, and additionally a 10-15% reduction in production costs as well. Due to the successful commercialization of FINEX, POSCO has been able to maintain their position as the most competitive steel maker in the world for 8 years, and to sustain competitive advantage as an innovator not only by reducing the production cost but also by exporting its process to the other steel makers.

While interviewing about the invention of FINEX technology, the interviewee mentioned that

"In regard to the creating this technology, many steel makers had challenged it before POSCO did. Although theoretically creating this technology was feasible, most of the steel makers whose level of technology are higher than POSCP had failed to make it practically. However the only reason why POSCO achieved and the others did not is that POSCO could persistently tried and learned until the outcome came out, but the others did not"

This statement is in the same line with the argument of Henderson and Clark's study (1990) regarding architectural innovation. In the case of existing firms with their competitive advantage, it is more difficult to break their knowledge scopes and rebuild them in different ways than just to acquire or build its new knowledge scope. They even argued that this is why the existing firms sometimes fail to compete with

new competitors in industrial competitors.

Based on the case of POSCO, this research argues that in revival stage, RUCAP could enhance competitive advantages of the firm. To exert RUCAP efficiently, this case shows that firms should 1) systemize its organizational system more in decentralized way, 2) encourage their employees to facilitate creativity and generate innovative ideas through autonomous environment, and 3) be persistent to its knowledge creation with continuous efforts. Therefore, it can conclude the final proposition.

Proposition 5: At the renewal stage of the firm, the importance of RUCAP increases, but it requires some organizational effort to facilitate innovative atmosphere.

By connecting the organizational learning capabilities with the firm's growth stage, this research has elicited some propositions in terms of the changes of organizational learning and the dominant organizational capabilities. Therefore, in overall, we can infer that at the early stage of the firm's growth the function of ACAP is more important, however, as a firm evolves, the function of CCAP is more important. Looking at the big picture, the dominant usage of which capabilities is similar, but the propositions can be slightly vary in accordance with the characteristics of industries.

4.3Discussion

Through the longitudinal case study of POSCO, this research attempts to connect the development of learning capability and the firm's growth. By connecting the technical development and exercise of learning capability in each stage, this research gives both theoretical and empirical implications; theoretically, the case study shows the offered framework in this study can effectively analyze the development of the firm's organizational learning. Empirically, in terms of context, it can argue that as a firm is getting matured, the importance of learning capability changes from ACAP to CCAP. Therefore, analogous to the implications of case study, I elicit some critical points about the offered framework, and capability development according to firm's growth.

Firstly, the offered framework suggests the pattern of capability development in organizational learning. The offered framework depicts how the organization can deal with the knowledge in accordance with evolution of its capability which goes through ACAP to CCAP. Especially it shows the pattern of knowledge recipient evolution from knowledge learner to knowledge creator. However, is this pattern generally valid for all the organizations? Or is this only one of patterns which expresses various developmental paths of organizational learning? Regarding this questions, I would argue that the pattern shown in the offered framework is applicable to learning development in all organizations, but in terms of periods which takes to go to next stage can vary according to the organizations. That is, some organizations might take equally similar amount time in each stage so that everyone can notice the development of the patterns. On the other hand, others might pass one specific stage too fast to make everyone confused whether they skip

one stage or go through it. Moreover, in terms of the degree which each capability have been developed, it might be affected to the other factors such as effort of organization, the level of prior knowledge. Like absorptive capacity, which is affected by a lot of determinants (Lane & Lubatkin, 1998; Tasi, 2001; Jansen, et al., 2005; Mahmood, et al., 2011)**,** the offered pattern can be affected by a lot of determinants, and these determinants can control the speed and quality the capability development occurs. Similarly, the offered framework is more likely to be the firm's growth stage model. Firm's growth stage model shows general patterns of firm's life starting from birth to death. So from broad perspective this general pattern is applicable to all firms, and able to analyze the firm's life cycle. However, in terms of specific context, it might be hard to standardize the growth of all firms in the same way. To some firms, although their history and existence is long, some firms are still in the early stage of their life. However, to the others, although their history is short, they are already in mature stage of their life. Analogues to this concept, the capability development in organizational learning does not have to be consistent with the firm's history or firm's age. Therefore, I claim that this offered framework emphasizes on the general patterns of capability development rather than the specific division of capability development.

Secondly, in the context of case study, it argues that as firm grows, the learning capability evolve from ACAP to CCAP. Likewise, the dominance of learning capability changes from ACAP to CCAP. This change in dominant learning capability gives an implication that successful innovation requires the dynamic evolution of learning capability which can deal with the knowledge more flexible

way. Moreover, another implication is that as firm grows, handling its knowledge is more important than learning the knowledge itself. So although the firm learn and acquire knowledge from the others a lot, in early stage, as the firm is mature, it should have their capability to create its knowledge. That is, as best cooks have their own recipes to make their own best dishes, firms should have their own capabilities to create their own knowledge. Therefore, while learning the knowledge from the others, the firm should also foster its own capability to handle knowledge for future. This finding might answer the circumstance that how the second tier firms catch up the frontier firms in industrial competition. Specially we have observed that many firms from emerging economies took the industrial initiative in global competition, especially in the high tech industries. So this implication might offer an explanation for the phenomenon that knowledge leaner firms become knowledge creators in real business world.

5. Conclusion

Today, the firm's organizational learning has been important an issue not only among business scholars but also among the business people in real society. The scholarly and practical interests brought the proliferations of the research in organizational learning, and many scholars have attempted to explain how the

organizational learning can contribute to the competitiveness of the firm. Scholars have focused a lot of firm's learning capabilities, but not many scholars have explained how these capabilities evolve according to firm's acquired knowledge management, starting from exploration to exploitation. To fill this gap, this paper has advanced the understanding of the development of learning capability from dynamic perspective. After a close review of literatures about ACAP and CCAP, this research argues that the knowledge management process especially from exploration to exploitation can be explained by combining both ACAP and CCAP. Here, I think that the process from exploration to exploitation is consistent with the process which the acquired knowledge is managed within a firm, so this paper regards the scope of research as an extension of knowledge transfer from the recipient perspective. To explain the process from exploration to exploitation, the conceptual framework of development of learning capability is introduced by combining with ACAP and CCAP and the each dimension of the framework is explained theoretically and empirically.

Accordingly, this paper makes three contributions to the academic field. First, through literature review it has offered clear distinction about similarities and differences between two concepts, ACAP and CCAP. Second, based on these distinguished characteristics, the research has offered the combined framework which shows the dynamic process of learning capability development. Lastly, the research has made a connection between firm's growth stages and the development of organizational capacity through case study, and elicits propositions. All these three contributions, at least I hope, can be the central to the analysis of the dynamic

process of organizational learning.

However, it also leaves an opening for the future studies. Firstly, as mentioned earlier, most of researches about organizational learning focus on the interaction between individual cognitive structure and organizational cognitive structure: how the individual cognitive structure can affect on or can be affected by organizational cognitive structures. Although I assume that there definitely exists the interaction between two especially as the capabilities evolve, I leave this area as an implicit premises in my study. Therefore, it needs to study the interaction between individual cognitive structure and firm's learning capability, as learning capability evolves. Secondly, although there have been many researches about the determinants of two capabilities recently, this research does not account for the determinants or activation triggers of the capabilities, and what determinants is more crucial at each stage of firm's development. Indeed, I have attempted to find the activation triggers which act more vigorously at each stage of firm's development based on the case study. However, I could not give clear indications about the activation triggers which influence on the firm's capacity growth at each stage. Since it is more likely to be anecdotal evidence, the findings cannot be generalized and it might vary depending on the firm, industry, or the competition environment. Therefore, activation triggers should be more scrutinized at each stage of the firm's evolution for the further study. Lastly, since this paper has just offered one empirical study with the case of Korean steel maker, so there is a need for more empirical studies.

In conclusion, this research attempts to give more a clear understanding of development of learning capability in organizational learning, and hopefully, the

research will give some implication toward the business strategy field especially for organizational learning and the firm's evolution, and its competitive environment in the future.

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국문초록

Dynamic perspective of capability development in organizational learning

-From absorptive capacity to combinative capability-

기업에서의 조직학습이 성공적인 이노베이션의 핵심으로 관심을 받으면서, 많은 학자들이 기업의 학습능력인 흡수역량 (Cohen and Levinthal, 1990; Zahra and George, 2002)과 지식을 통합하는 결합역량(Kogut and Zander, 1992; Grant, 1996)에 대한 연구를 진행하였다. 그러나 지속적인 학문적 관심에도 불구하고, 기존연구는 두 가지 한계점을 가지고 있다. 첫 번째, 기업의 이 두 역량이 지속적으로 연구되고 발전함에 따라 두 개념은 원래의 요지를 잃고 개념의 확장을 갖게 되었다. 두 번째, 또한 이러한 역량을 바라보는 관점이 조직학습의 부분만을 강조함에 따라 시간의 흐름에 따른 전체적인 기업의 학습역량의 발전을 간과하게 되었다.

본 연구는 이러한 흡수역량과 결합역량의 개념들의 확장이 가져온 공통적인 특성이 이 두 가지 학습 역량을 서로 연결 시킬 수 있다는 것과 이

연결을 통해 두 개념을 결합한 형태의 모델을 제시하였다. 즉, 첫 번째로 확장된 두 개념 사이에 발생한 공통점과 차이점을 명확히 구별하였다. 또한, 서로의 공통점과 차이점을 바탕으로 밝혀진 각각의 특성들이 기업 내 학습의 전체 프로세스인 지식의 탐사가 지식의 활용으로 이루어지는 전체 프로세스를 설명해 줄 수 있음을 주장한다.

두 번째로, 각각이 가진 공통점을 바탕으로 연결한 모델이 조직이 지식을 다루는 정도에 따라 학습역량이 어떻게 발전되는지를 보여줄 수 있음을 주장한다. 특히 이 논문에서는 조직의 학습역량의 발전이 외부 지식을 탐사하고 그 탐사를 통해 얻은 지식을 활용하는 지식관리 과정과 동일하다고 보았기 때문에, 연구에서 제시되는 모델은 학습역량의 발전이 흡수역량에서 결합역량으로 진행이 된다고 주장하고 있다. 즉 이 연구는 지식수용자가 거치는 지식 탐사와 활용의 프로세스를 흡수역량과 결합역량을 연결한 모델로써 보여준다고 할 수 있다. 이 모델에서 기업의 학습역량은 기존 지식을 분해하고 분해된 지식을 활용하는 정도에 따라 발전한다고 보았으며, 연구에서는 각각의 단계에서 지니는 학습역량의 성격에 대하여 구체적인 내용을 기술하였다.

게다가 이 연구는 POSCO 사례연구를 통해 기업의 성장단계와 조직의 학습역량의 발전을 연결하는 시도를 하였다. 특히 기업의 성장 5단계 모델(Miller and Friesen; 1984), 을 바탕으로, POSCO의 창립부터 현재까지를 각각 4단계로 구분하였고, 학습역량의 발전을 바탕으로 분석하였다.

사례연구를 통해서 저자는 이론적, 실증적 두 가지 의의를 발견하였다. 먼저 이론적으로 논문에서 제시된 학습역량발전 모델이 기업의 조직학습의 발전을 효과적으로 설명할 수 있음을 발견하였으며, 실증적으로는 이 사례연구가 기업이 성장함에 따라 한 특정 산업의 지식 학습자에서 지식 창조자로 변화해 나아가는 과정을 증명해 냄을 발견하였다.

결론적으로 이 연구는 세 가지 중요점에 대하여 의의를 갖는다. 첫 번째로 학습역량과 결합역량을 분석함으로써 두 역량이 가지는 공통점과 차이점을 명확하게 구분하였다. 두 번째로 이 두 가지 개념을 합한 모델을 제시함으로써 지식수용자의 관점에서 지식탐사에서 활용으로 이어지는 과정을 규명하였다. 마지막으로 사례연구를 통해 기업의 성장단계와 학습역량 발전의 관계를 추론하고, 각각의 기업성장단계에서 가지는 학습역량의 중요성에 관한 명제를 이끌어 내었다.

Key word: 조직학습. 흡수역량, 결합역량, 역동적 관점,
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